

# ANNUAL REPORT FOR 2007



**Indian Creek Mitigation Site  
Lincoln County  
TIP No. R-0617BA**



Prepared By:  
Natural Environment Unit & Roadside Environmental Unit  
North Carolina Department of Transportation  
January 2008

## TABLE OF CONTENTS

SUMMARY .....	1
1.0 INTRODUCTION .....	2
1.1 Project Description .....	2
1.2 Purpose.....	2
1.3 Project History.....	2
2.0 HYDROLOGY .....	4
2.1 Success Criteria .....	4
2.2 Hydrologic Description .....	4
2.3 Results of Hydrologic Monitoring .....	6
2.3.1 Site Data .....	6
2.3.2 Climatic Data.....	8
2.4 Conclusions .....	8
3.0 VEGETATION.....	10
3.1 Success Criteria .....	10
3.2 Description of Species .....	10
3.3 Results of Vegetation Monitoring .....	11
3.4 Conclusions .....	11
4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS .....	11

### **FIGURES**

Figure 1. Site Location Map .....	3
Figure 2. Gauge Location Map. ....	5
Figure 3. Hydrologic Monitoring Gauge Results. ....	7
Figure 4. 30 <sup>th</sup> -70 <sup>th</sup> Percentile Graph.....	9

### **TABLES**

Table 1. Hydrologic Monitoring Results .....	6
Table 2. Vegetation Monitoring Results .....	11

### **APPENDICES**

APPENDIX A - GAUGE DATA GRAPHS  
APPENDIX B - SITE PHOTOGRAPHS

## **SUMMARY**

The following report summarizes the monitoring activities that have occurred in the past year at the Indian Creek Mitigation Site. Site construction began in February 2005 and was completed within the same month. Monitoring activities in 2007 represent the third year of monitoring for the site. The site must demonstrate both hydrologic and vegetation success for a minimum of five years or until the site is deemed successful.

The site is monitored with four groundwater gauges, one rain gauge and one vegetation plot.

The daily rainfall data depicted on the monitoring gauge graphs was recorded from an onsite rain gauge. An offsite rain gauge, maintained by the NC State Climate Office in Lincolnton, contributed to the daily rainfall data and historical rainfall data used for the 30<sup>th</sup> – 70<sup>th</sup> percentile analysis.

Hydrologic success criteria are based on the approved mitigation plan and require that the site demonstrate saturation or inundation within 12 inches of the soil surface for a consecutive 10% of the growing season during years of normal rainfall. According to the Drought Management Advisory Council for North Carolina, Lincoln County experienced exceptional drought conditions for 2007.

The 2007-year represents the third year for hydrology monitoring. One of the two groundwater gauges located in the wetland preservation area exceeded the success criteria with saturation within 12" of the soil surface for greater than 10% of the growing season. The other gauge experienced a gauge malfunction at the beginning of the growing season, resulting in the gauge not meeting the success criteria. The two gauges located in the wetland creation area did not meet the success criteria. The two gauges along with the creation area will be analyzed by NCDOT.

The 2007 vegetation monitoring of the site revealed an average density of 418 trees per acre, which is above the minimum success criteria of 320 trees per acre.

NCDOT will continue to monitor the Indian Creek Mitigation Site for hydrology and vegetation.

## 1.0 INTRODUCTION

### 1.1 Project Description

The Indian Creek Mitigation Site is located on Pleasant Union Church Road, south of Lincolnton and just north of the town of Crouse. The site is adjacent to Indian Creek in Lincoln County (Figure 1). NCDOT is using onsite mitigation at the Indian Creek Site to offset impacts to existing wetlands and streams from the construction of NC 150 in Lincoln County.

The Indian Creek Site consists of approximately 20.0 acres of wetland creation, enhancement, and preservation, stream enhancement (with riparian buffer restoration and enhancement) and uplands enhancement and preservation.

Headwater wetlands were created through minor grading of deforested uplands (0.6 acre). Wetland enhancement consisted of planting approximately 0.9acre of existing emergent wetland and the preservation area included approximately 6.2 acres of headwater and scrub-shrub wetlands. Stream enhancement was performed on approximately 1,280 feet of channel and included 480 feet of buffer restoration and 800 feet of buffer preservation (3.0 acres total). Uplands (6.4 acres) were enhanced through planting while 4.4 acres of upland were preserved on the Indian Creek Mitigation Site.

### 1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years. Success criteria for hydrology and vegetation are based on the approved mitigation plan dated August 2002. The following report details the results of hydrologic and vegetative monitoring activities that were performed during the 2007 growing season at the Indian Creek Mitigation Site.

### 1.3 Project History

February 2005	Site Planted
March-November 2005	Hydrology Monitoring (Year 1)
July 2005	Vegetation Monitoring (Year 1)
March-November 2006	Hydrology Monitoring (Year 2)
July 2006	Vegetation Monitoring (Year 2)
March-November 2007	Hydrology Monitoring (Year 3)
August 2007	Vegetation Monitoring (Year 3)

Figure 1. Site Location Map



## **2.0 HYDROLOGY**

### **2.1 Success Criteria**

Per the approved mitigation plan dated August 2002, groundwater hydrology on the Indian Creek Mitigation Site shall be monitored for five years following the completion of all implementation activities, or until hydrologic success criteria are met. As stated in the mitigation plan, hydrologic success is defined as inundated or saturated soil conditions within a major portion of the root zone (within 12 inches of the soil surface) for greater than or equal to 10% of the growing season in normal years.

The growing season in Lincoln County begins March 28 and ends November 4. These dates correspond to a 50% probability that temperatures will drop to 24°F or lower after March 28 and before November 4.<sup>1</sup> The growing season is 222 days; therefore, optimum hydrology requires 10% of this season, or at least 22 consecutive days.

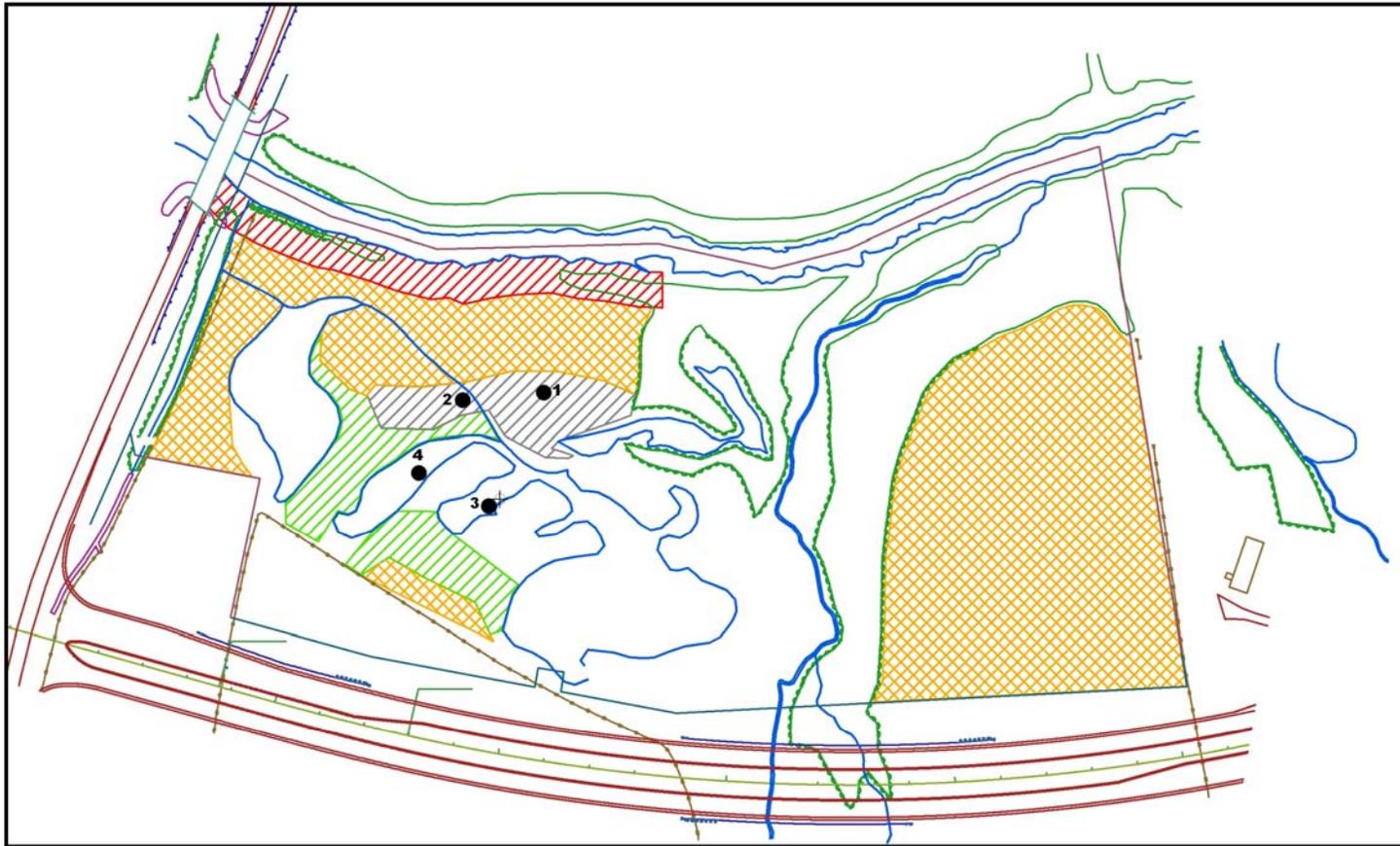
### **2.2 Hydrologic Description**

In March 2005, four groundwater gauges were installed across the site (Figure 2). The automatic monitoring gauges record daily readings of groundwater depth. The 2007 year represents the third growing season that the monitoring gauges have been in place since construction of the site.

The Indian Creek Site was designed to restore the groundwater hydrology on the site.

---

<sup>1</sup> Soil Conservation Service, Soil Survey of Lincoln County, North Carolina.



**Figure 2. Gauge Location Map**

- |                     |                       |                               |
|---------------------|-----------------------|-------------------------------|
| ● Groundwater Gauge | ▨ Wetland Creation    | ▨ Riparian Buffer Restoration |
| ⊕ Rain Gauge        | ▨ Wetland Enhancement | ▨ Upland Buffer Enhancement   |

0 50 100 200 Feet



## 2.3 Results of Hydrologic Monitoring

### 2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each gauge. This number was converted into a percentage of the 222-day growing season. The results are presented in Table 1. Figure 3 also provides a graphical representation of the hydrologic results. Gauges highlighted in blue indicate wetland hydrology for more than 10% of the growing season. Gauges highlighted in red show hydrology between 5% and 10% of the growing season. Those gauges highlighted in black indicate no wetland hydrology (< 5% of the growing season).

Appendix A contains a plot of the groundwater depth for each monitoring gauge. The maximum number of consecutive days is noted on each graph. An onsite rain gauge was used to obtain rainfall data from the site. It has been compared with rainfall data acquired from the State Climate Office Local Weather Station in Lincolnton.

**Table 1.** Hydrologic Monitoring Results

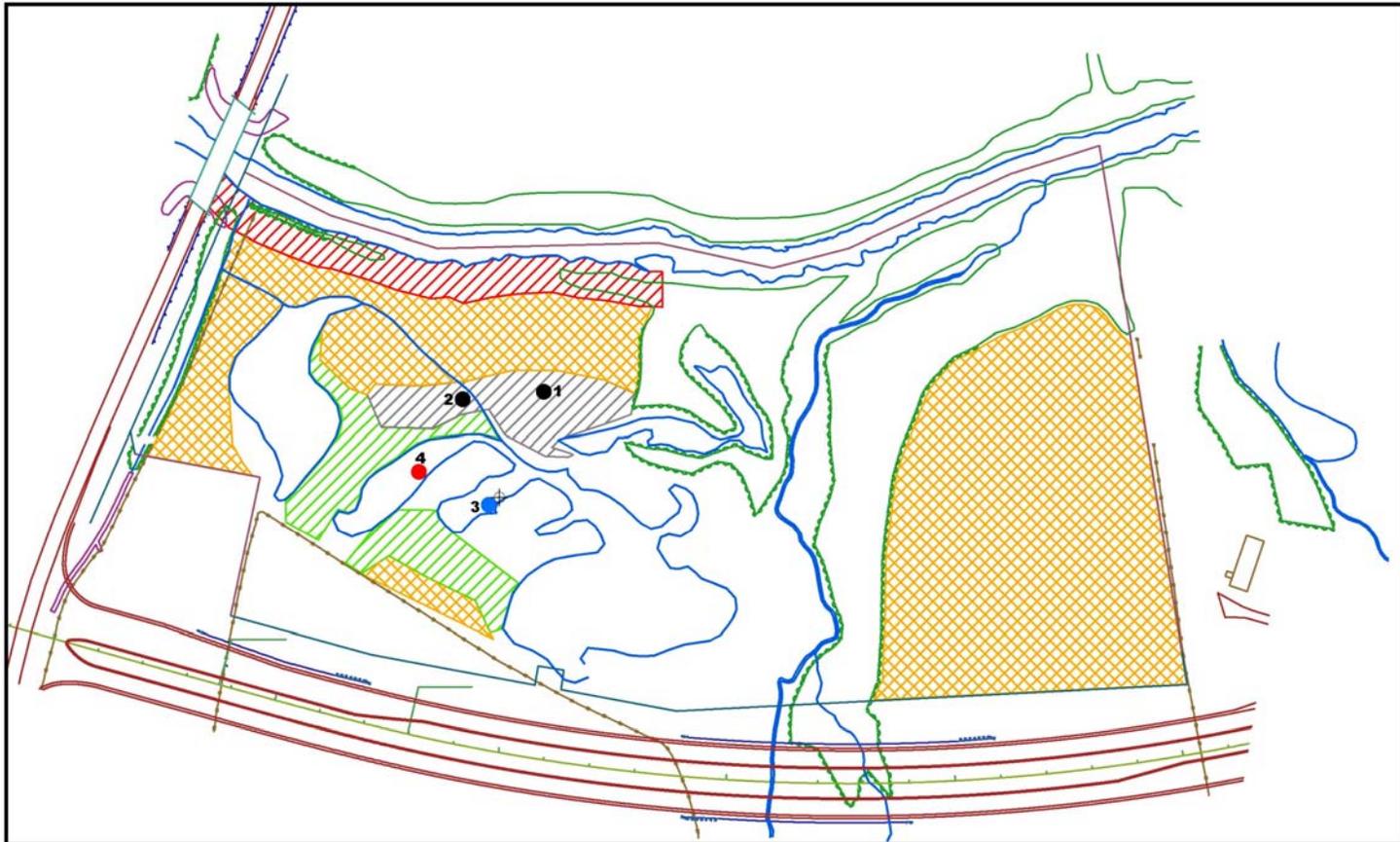
Monitoring Gauge	<5%	5%-10%	>10.0%	Actual %	Success Dates
GW-1 (Creation)	X			1.4	
GW-2 (Creation)	X			1.4	
GW-3+			X	27.5	March 28-May 27 June 12-July 1
GW-4		X		6.3	April 19-May 2

Shaded gauges are gauges located in the preservation area.

+Gauge met success during an average rainfall month (March, April, and June).

#### *Specific Gauge Problems:*

- Gauge (GW-4) experienced malfunction and stopped recording data (March 21-April 18)



**Figure 3. 2007 Hydrologic Monitoring Gauge Results**

- 0 - < 5%
- 5 - 10.0%
- > 10.0%
- ⊕ Rain Gauge



Wetland Creation



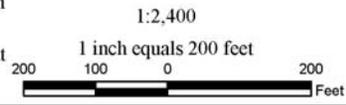
Wetland Enhancement



Riparian Buffer Restoration



Upland Buffer Enhancement



### **2.3.2 Climatic Data**

Figure 4 is a comparison of monthly rainfall for the period of November 2006 through November 2007 to historical precipitation (collected between 1976 and 2007) for Lincolnton, North Carolina. This comparison gives an indication of how 2007 relates to historical data in terms of climate conditions. The NC State Climate Office provided all historical rainfall information.

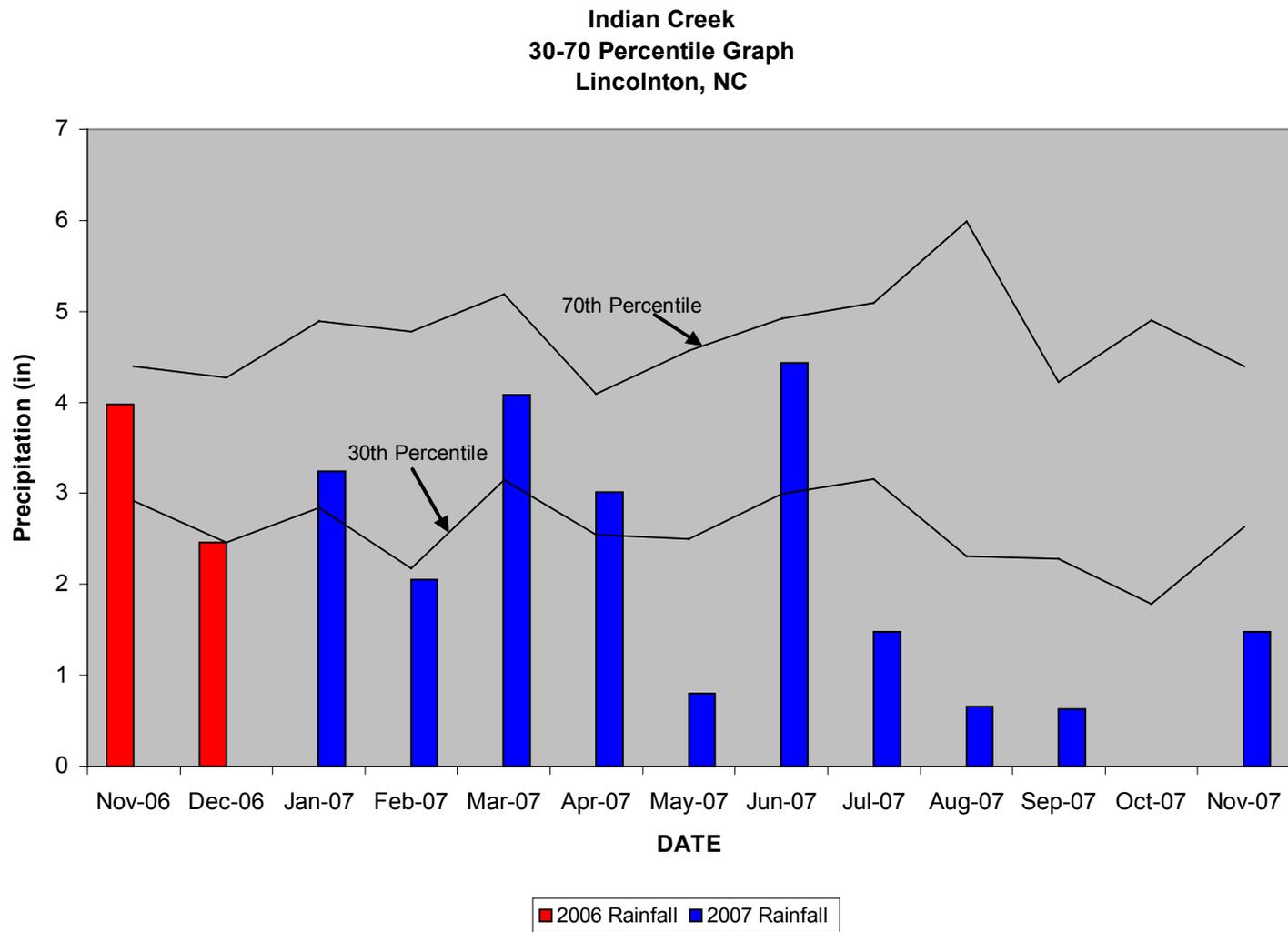
For 2007, February, May, July, August, September, October, and November recorded below average rainfall for the site. The months of January, March, April and June recorded average rainfall. Due to the drought, 2007 was a below average rainfall year.

### **2.4 Conclusions**

2007 represents the third year of hydrology monitoring. One of the two groundwater gauges located in the wetland preservation area exceeded the success criteria of saturation within 12" of the soil surface for greater than 10% of the growing season. The other gauge located in the preservation area experienced a gauge malfunction at the beginning of the growing season resulting in the gauge meeting only 6.3% of the growing season. The two gauges located in the wetland creation area did not meet the success criteria. The two gauges along with the creation area will be analyzed by NCDOT.

NCDOT will continue to monitor the hydrology at the Indian Creek Mitigation Site.

**Figure 4: 30-70 Percentile Graph**



### **3.0 VEGETATION: INDIAN CREEK MITIGATION SITE (YEAR 3 MONITORING)**

#### **3.1 Success Criteria**

Success criteria have been established to verify that wetland creation areas support the vegetation necessary for a jurisdictional determination. Additional success criteria are dependent upon the density and growth of characteristic forest species. For the forested wetlands, a minimum count of 320 trees per acre must be achieved within three years of the initial planting with a minimum count of 260 trees per acre within five years of initial planting.

#### **3.2 Description of Species**

The following tree species were planted in the Buffer, Creation, and Enhancement Areas:

*Betula nigra*, River Birch  
*Fraxinus pennsylvanica*, Green Ash  
*Quercus nigra*, Water Oak  
*Quercus phellos*, Willow Oak  
*Platanus occidentalis*, Sycamore  
*Quercus alba*, White Oak

The following tree species were planted in the Upland Area:

*Quercus alba*, White Oak  
*Quercus phellos*, Willow Oak  
*Liriodendron tulipifera*, Tulip Poplar  
*Juglans nigra*, Black Walnut  
*Prunus serotina*, Black Cherry

### 3.3 Results of Vegetation Monitoring

**Table 2.** Vegetation Monitoring Results

Plot #	River Birch	Green Ash	Water Oak	Willow Oak	Sycamore	White Oak	Total (3 year)	Total (at planting)	Density (Trees/Acre)
1	10		5	12	8		35	57	418
Average Density Trees/Acre									418

**Site Notes:** Other vegetation noted: goldenrod, fennel, poison ivy, sweetgum, woolgrass, red maple, *Juncus* sp., horse-nettle, black willow, blackgum and various grasses. Green ash was noted in the creation area, though none were counted in the plot. There was some ATV and vehicle activity noted on site during the monitoring evaluation in the upland buffer enhancement area (photos 4 and 5) and steps are being taken to stop the vehicular trespass.

### 3.4 Conclusions

There was one vegetation monitoring plot established throughout the 1.5-acre creation area. The 2007 vegetation monitoring of the site revealed an average tree density of 418 trees per acre. This average is above the minimum success criteria of 320 trees per acre.

## 4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

One of the four groundwater monitoring gauges met the hydrology success criteria at the Indian Creek Mitigation Site in 2007. The gauge located in the preservation area experienced a gauge malfunction at the beginning of the growing season, resulting in the gauge meeting hydrology only 6.3% of the growing season. The two gauges that are located in the wetland creation area recorded hydrology for less than 5% (consecutive) of the growing season. NCDOT will investigate the gauges along with the creation area that failed to meet the success criteria during the 2007 monitoring year.

The site had an average density of 418 trees per acre, which is above the minimum success criteria of 320 trees per acre.

NCDOT will continue to monitor the Indian Creek Mitigation site for hydrology and vegetation.

**APPENDIX A**

**GAUGE DATA GRAPHS**

**APPENDIX B**

**SITE PHOTOGRAPHS**

**PHOTO LOCATIONS & MONITORING PLOTS**

# Indian Creek



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5

August 2007

